Problems & Prospects of Cloud Computing in India

Deka Ganesh Chandra, Tomar GS

DGE&T, MoLE New Delhi, India

MIR Lab, India

Abstract - On-demand, Service-oriented cloud computing infrastructures continue to amplify popularity with organizations. In India cloud computing research and development is yet to take active role despite of huge potential in terms both human resources, marketing IT products & Services. It has remarkable relevance in India given the fact that cloud computing provides sharing of common resources at multiple locations in a very economical way. In this paper, we will analyze the problems & prospects of Cloud computing in the sunshine area of e-Governance & Education.

Keywords – National Knowledge Network(NKN),Virtual Computing Lab(VCL),NeGP,Cloud Computing & Distance Education.

I. Introduction

In the current financial crisis and being challenged by growing needs, educational Institutions are facing problems in providing necessary Information Technology (IT) support for educational, research and development activities. Educational institutions are under increasing pressure to deliver more for less and they need to find ways to offer rich, affordable services and tools [2]. With cloud computing as part of IT strategy, an organization can increase their data capacity without compromising security or requiring the school, college or university to make heavy infrastructure investments-all while helping to lower the total cost of ownership. The trick is to find the right balance of on-premise and cloud services for the education institution.

Cloud computing and related business models provide answers to many of the challenges faced by the Indian educational sector. It's a network of computing resources-located just about anywhere-that can be shared. They bring to education a range of options not found in traditional IT models.

Integration of software and assets own by an organization with software and services in the cloud provides the organization with new choices for balancing system management, cost and security while helping to improve services. Higher utilization meets a business need to fill the installed capacity with new users by allowing a flexible cloud environment. Amazon uses this concept for their Elastic Compute Cloud [4] . This allows them to rent their servers with a reduced Total Cost of Ownership (TCO) for their customers [5].

The benefits of Cloud computing can be cost based including reducing or shifting expenses, enabling agility, flexibility and if deployed properly, even survivability.

- Easy to manage with no or very little IT support
- Predictable monthly payments that helps immensely for budget planning.
- Scalability and flexibility as the services can be increased or contracted as and when required.

Government organizations are facing challenges [6] from all sides and with an intensity not seen for decades. Budgets are shrinking, demand for services is increasing and technology advances have empowered citizens with access and tools that allow them to become participants, not just consumers of public services. Capital expenses for new technology are hard to justify when so much money is needed for mission performance in these times of escalating expectations.

The rest of this paper is organized into 8 Sections. Section-2 is about application of Cloud Computing in Education, Section-3 is about the cloud computing in e-Governance. Section-4 is an introduction to National

Knowledge Network (NKN) while Section-5 is about the 5 Steps for successful integrated Cloud management. Section-6 is about the Challenges of Cloud Computing. Section-7 is about the top 10 IT trends as forecasted by Gartner and finally Section-8 is our observations & conclusion.

II. Application of Cloud Computing in Education

The development of the education sector is solution for economic growth and improvement in the standard of living. The education sector is the second largest sector globally and Indian school system is the world's largest school system with over 1.12 million schools. In India we have 42 Central Universities, 280 State Universities (as on 26th August, 2011), 130 Deemed Universities and 94 Private Universities [7].

The challenges posed by the growing appetite for education requirements are immense. India will have about 45 million people in the age group of 18 years to 20 years by 2020. To train them, we need more than 20 million teachers and the present vacant post of teachers in India is 1.2 million as on 05.09.2011. As per present trends, we will create only 20,000 teachers by 2020[1].

Both public and private institutions can use the cloud to deliver better services, even as they work with fewer resources. At any given time, the user does not know which physical location is providing the e-mail service, and thus considers it to be residing in a Cloud.

Another advantage of cloud computing is the economy of scale. Utilization of servers inside an enterprise, a small medium business (SMB) or even on a home computer can vary widely but rarely reaching a near 100% utilization at all times. In fact, averaged over 24 hours and 7 days a week, a recent IEEE study showed that most servers will show CPU utilization between 10 and 15% and same is true for network bandwidth [3]. Storage too is underutilized.

Combining the usage of several such underutilized data-centers enables the operators of that data-center to spread their capital investment over a large number of customers. The sharing of resources can drive the supply-side utilization to be higher.

Internet has a lot of Web 2.0 tools such as iGoogle that can personalize the web space, Diigo bookmarks to create a personal taste, Sakai management network courses etc. These Web 2.0 tools belong to the cloud services areas, support in the cloud. The basic elements of personal learning environments, such as text, audio and video, training and so can be achieved by the control and management of cloud services. We just need to connect through the browser easily and freely to create personalized learning environment for virtual classrooms on-site, teachers and students through the network at any time, any place to communicate. Do not need to master complex software operation, which greatly reduces the learning environment construction threshold.

Under the patterns of cloud computing environment, the construction of Net-teaching database made a modern network of teaching resource library building where many can learn from.

In future cloud computing environment we have to consider the issues to how to build online teaching resource library. Library building is a long-term project, there must be long-term planning. Teaching Resources to support teaching and research should be the ultimate objective, the construction should follow the overall planning process, division of labor, focusing on the application of the basic principles of mechanism innovation, make full use of existing resources. Reasonable classification, organize, and absorb the latest, the excellent results of external, with cloud computing services provided ideas and services to IT architecture, innovation, construction of scientific quality, efficient and appropriate teaching resources library. Cloud computing environment teaching resource library has the following characteristics:

- Stable, with a powerful, convenient, fast search and query capabilities;

- Standardization, classification specifications, user edit and use. Conducive to building the sustainability of the repository.
- All information and data are in the clouds, local no need to retain and backup.
- All types of users at all levels can be quickly and easily find the resources and the corresponding functions, and can be easily controlled cloud and treatment.

Educational resources to achieve maximum openness and sharing both Microsoft and Google have launched their own cloud computing platform. Many schools are now using Google Earth Community to carry out the geography class teaching, a good example of using Google cloud services. Of course, we can also rent network space, create their own network platform, not only eliminates the need to purchase a large number of hardware devices, but also to eliminate the trouble of maintaining the system, in line with our current status of information technology in education, which also contributed to the diversified development of educational information.

III. Cloud Computing in e-Governance

The first step of e-Governance in India was the Computerization of Government Departments. Present e-Governance initiatives will be encapsulating the finer points of Governance for instance Citizen Centricity, Service Orientation & Transparency. The most expected benefits of e-Governance includes improved efficiency, convenience, and better accessibility of public services.

On 18th May 2006 Government of India approved NeGP which consists of 20 Mission Mode Projects (MMPs) of State Governments & Central Government and 7 Integrated Mission Mode Projects (MMPs). The theme of the NeGP is to “Make all Government services accessible to the common man in his locality, through common service delivery outlets, and ensure efficiency, transparency, and reliability of such services at affordable costs to realize the basic needs of the common man”.

It is increasingly evident that the public sector needs a new model (Cloud Computing) using the Internet as the primary channel for communication and services delivery.

The Cloud computing delivery has proven to do just that, for example, the Infrastructure Cloud delivers the highest value for services with the lowest capital expense. Cloud computing is both economically and environmentally green.

Advances in e-Government oriented technologies and services are taking place with a considerable speed around the world. Recent attention has shifted away from these traditional online services (e-Government) to a new initiative-Cloud Government (C-government). That is, incorporating Cloud computing into e-Government services, particularly those aimed at communicating directly with citizens and implementing Cloud computing services in order to cut costs and improve upon the services system infrastructure. The developments in e-Business and c-Business areas are driving Cloud computing technology adoption [8] by governments.

m-Government cell is being created under the Department of Information Technology’s(DITs) e-Governance unit with a mix group of 1,500 officials, comprising members from the Academy, Industry stake holder, civil society(Non-Government organizations) and officials from DIT and Department of Telecommunication. The aim is to deliver all services presently available through computers through Mobile Technology.

IV. National Knowledge Network(NKN)

NKN was approved in March 2010 by the Cabinet with an outlay of INR 5990 Crores. The NKN [9] is a state-of-the-art multi-gigabit pan-India network for providing a unified high speed network backbone for all knowledge related institutions in the country. The purpose of such a knowledge network goes to the very core of the country's quest for building quality institutions with requisite research facilities and creating a pool of highly trained professionals. The NKN will enable scientists, researchers and students from different backgrounds and diverse geographies to work closely for advancing human development in critical and emerging areas. NKN has already connected 300 institutions and aims to connect over 1500 Institutions/Organizations/Laboratories under various categories throughout the country.

V. 5 Steps to Successful Integrated Cloud Management

A recent global IDC survey, sponsored by HP, examined the experience of this proactive group of integrated cloud managers. These organizations are actively integrating and automating application development, provisioning, security, and management across public and private cloud resources as well as non-cloud application development and datacenter operations teams.

They are seeing many benefits, including faster application provisioning, lower application development and maintenance costs, improved business agility, higher service levels, and improved business and IT relationships. Their experiences also highlight that success depends on cultural transformation as well as integrated and automated management processes and tools.

An analysis of the experiences of these early adopters identifies five important steps for successful integrated cloud management. Specifically:

- Define a plan that coordinates the organization’s application modernization strategy with its cloud infrastructure and SaaS agenda
- Assess current costs and develop benchmarks for application support, provisioning, and ongoing resource consumption
- Identify opportunities to reduce costs and speed up service delivery via use of automation for integrated application and infrastructure provisioning
- Implement systems to monitor and integrate application performance and real-time capacity planning analytics with automated provisioning solutions
- Integrate security strategies and priorities across the application development, release, and operations life cycle IDC recommends that organizations begin the journey toward integrated cloud management by targeting early pilot projects at developer teams and application environments that can deliver quick payback to validate the business agility benefits and operational efficiency improvements.

Cloud computing in India could be a billion dollar market, smelling this prospect more and more companies are starting to provide cloud computing based services to Indian website owners and business houses.

According to IDC, India is facing an information explosion with digital data growing from 40,000 petabytes in 2010 to 2.3 million petabytes in 2020-with the cloud in the middle as Indian companies look for leveraging cost advantages [13]. In earlier news, IDC reported that the Indian cloud computing market would grow at a CAGR of 40 percent by 2014, and to become a $3 billion dollar market by 2015.

As a testament to this development, several research analysts have published predictions on the cloud growth in India:

According to a Gartner survey, Indian companies expect to adopt new cloud services in 2011 much faster than originally anticipated, with two-thirds of CIOs expecting the majority of IT to be running in the cloud within the next four years.

A study for EMC, conducted by Zinnov Management Consulting, finds that private cloud in India will deliver up to 50% saving to Indian enterprises creating in the process 100,000 additional jobs by 2015.

Furthermore, the CEO of Zinnov claims that cloud computing will reshape the Indian IT market by generating new opportunities for IT vendors and driving changes in traditional IT offerings.

Here we provide a list of top 10 cloud computing providers in India looking to match and compete against world class cloud venders such as Microsoft, Salesforce.com, Google or Amazon etc [12].

Infosys Technologies-This Company provides cloud computing services effectively and selectively. Large numbers of organizations are already associated with this Bangalore based company.

Reliance DataCenter– They is based on the Microsoft platform for Enterprises and SMBs. Under the banner of small division of Reliance Communications they are offering Cloud Computing Services. RDC is getting popularity all over India because it has the potential of delivering largest cloud infrastructure.

Synage-Based in Mumbai, India this Company is offering DeskAway, a SaaS which is delivered all over the world over the internet as the flagship products. It is available on zero installation charges, but you have to pay monthly or yearly subscription charges.

Netmagic *Solutions* is determined to become a big provider in future with collaboration with established giants providing cloud services.

Wipro Technologies has adopted new and very common trends in open standards and software engineering presently offering its services as Wipro w-SaaS.

SynapseIndia is providing cyn.in server. It is a cloud hosted service which allows to set up own server in short time period.

TCS is provides end to end IT solution to any problem for example business software, bandwidth, network and different types of hardware. It is offering IaaS and others as a service (+aaS).

OrangeScape is known to have made different complex business solutions applications in several industries. Numbers of world class clients are associated with the company.

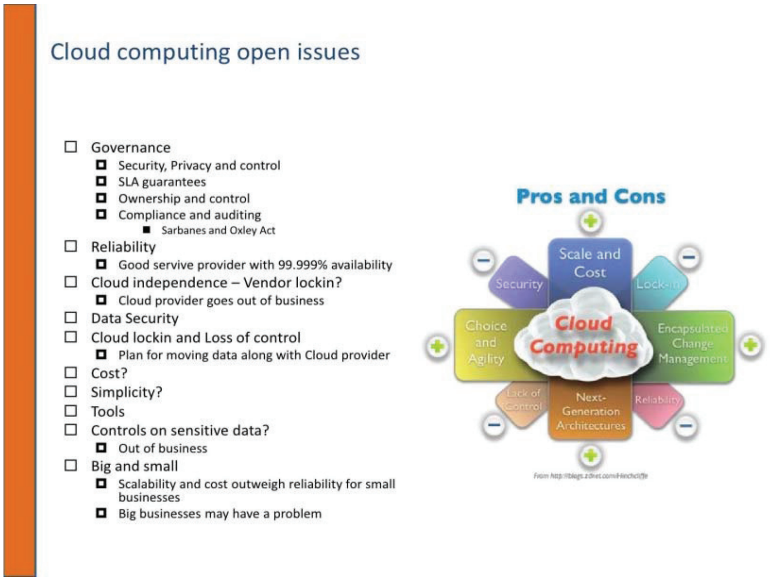
Wolf Frameworks-Browser based on demand platform provides reasonable cloud services. The company was founded in 2006 and since then has been delivering software and services for different applications.

Zenith InfoTech-The Company is offering IaaS-is known for its high ambitions in IT and long list of clients. This company is expecting more clients in few years.

VI. Challenges

The cloud computing open issues are:

- Governance
- Reliability
- Cloud Independence
- Data Security
- Cloud lock in & loss of Control
- Cost
- Simplicity
- Tools
- Control on sensitive data



Cloud computing open issues

- ☐ Governance
  - ▪ Security, Privacy and control
  - ▪ SLA guarantees
  - ▪ Ownership and control
  - ▪ Compliance and auditing
    - ▪ Sarbanes and Oxley Act
- ☐ Reliability
  - ▪ Good servive provider with 99.999% availability
- ☐ Cloud independence – Vendor lockin?
  - ▪ Cloud provider goes out of business
- ☐ Data Security
- ☐ Cloud lockin and Loss of control
  - ▪ Plan for moving data along with Cloud provider
- ☐ Cost?
- ☐ Simplicity?
- ☐ Tools
- ☐ Controls on sensitive data?
  - ▪ Out of business
- ☐ Big and small
  - ▪ Scalability and cost outweigh reliability for small businesses
  - ▪ Big businesses may have a problem

From http://blogs.zdnet.com/Hinchcliffe

With respect to data protection, special attention must be paid to the sensitive data from the institution (for example, research results, students' scholastic records, employees' accounts). The main options that may be taken regarding data are [11]:

- Maintain the sensitive data within the institution data centres and externalize the others with the risk of achieving a high latency for many applications and users
- Externalize all the data in order to obtain performance and maximum scalability with potential security risks.

As IT organizations support dynamically changing business priorities and cope with economic pressures, maintaining datacenter agility is critical By consolidating systems onto the latest server technology and taking advantage of virtualization techniques, enterprises can optimize datacenter efficiency, gain flexibility, and reduce operating costs-without sacrificing performance or impacting service levels[14].

VII. Top 10 Trends and Their Impact

The Evolution of Virtualization

Cappuccio says virtualization will ultimately drive more companies to treat IT like a business. The danger during the next few years will be in following a specific vendor's vision, though it is unlikely that any one vendor's vision will prevail. Users should have their own visions of architecture control and build toward it with a constantly updated strategic plan.

Big Data, Patterns and Analytic:

Unstructured data will grow some 80% over the course of the next 5 years, creating a huge IT challenge. Technologies such as in-line de-duplication, automated tiering of data to get the most efficient usage patterns per kilowatt and flash or solid-state drives for higher-end performance optimization, will increase in importance over the next few years, Cappuccio said. Analytics and other systems to monitor for recurring data patterns that could develop into money making applications will also be important.

Energy Efficiency and Monitoring

An average x86 server that is turned on, but idle, will draw upward of 65% of its nameplate wattage, for example. IT organizations need a clear inventory of what compute resources are doing and what workloads there is the potential for significant waste of energy.

Context Aware Apps

The big question here how to do something smart to take advantage of smartphones. Gartner has in the past said context-based computing will go beyond the business intelligence applications and truly make a unified communications environment possible by bringing together data culled from social networks and mobile-devices.

Staff Retention and Retraining:

Here the idea is developing a plan to get people excited about their jobs enough to stay. And we'll need is as starting in 2011 an average of 10,000 baby boomers will be eligible to retire every day for the next 19 years, Cappuccio said. Loyalty to one company is not a quality found in new workers.

Social Networks

Affordable and accessible technology has let individuals and communities come together in a new way, with a collective voice-to make statements about our organizations, the products/services we deliver and how we deliver them, Cappuccio said. The collective is made up of individuals, groups, communities, mobs, markets and firms that shape the direction of society and business. The collective is not new, but technology has made it more powerful -and enabled change to happen more rapidly Cappuccio said. The collective is just beginning to have an impact on business operations and strategies but most organizations do not have a plan for enabling or embracing it. Ignoring social networking is not an option, Cappuccio said.

Consumerization

The key trend here is the fact that new application types will be developed to address mobile users but they won't be desktop replacement applications. A secure, well-defined strategy needs to be put into place to take advantage of this development.

Compute Per Square Foot

Virtualization is one of the most critical components being used to increase densities and vertically scale data centers. If used wisely, average server performance can move from today's paltry 7% to 12% average to 40% to 50%, yielding huge benefits in floor space and energy savings. Two issues that need to be considered going forward are the number of cores per server 4 and 8 core systems is becoming common and 16 cores will be common within two years-and overall data center energy trends. IT will also have to address things like performance/licensing.

Cloud Computing

While cost is a potential benefit for small companies, the biggest benefits of cloud computing are built-in elasticity and scalability. As certain IT functions industrialize and become less customized, such as email, there are more possibilities for larger organizations to benefit from cloud computing.

Fabrics

Fabric is defines as the vertical integration of server, storage and network systems and components with element-level management software that lays the foundation to optimize shared data center resources efficiently and dynamically. Systems put forth so far by Cisco and HP will unify network control but are not there yet.

India really wants a tablet computer in every home and on every student's desktop. The Aakash tablet is aimed mostly at students and government workers. The device, made by DataWind, a Canadian wireless Web access products maker will sell for about s $38, runs the Android operating system and features a 7-inch display with 800X480 resolution, 256MB of RAM, 2GB flash storage, and a Connexant 366MHz processor[15].

VIII. Conclusion

Cloud computing applications in the education will be the future of Information Technology infrastructure of education, which includes educational information required for the development of software and hardware environment for resources [1]. Integration of these resources by way of cloud computing will be able to meet the massive demand for high speed processing of data to ease the current information age 'information explosion' of the pressure; meet the educational development of the rapid changes in IT and software as a service(SaaS) trend; greatly enhance the Kinds of educational resource utilization, reduce costs, meet demand for green energy; is conducive to centralized management, ease of operation and maintenance, and ultimately will enhance information security. The following table shows the cloud computing market predicted by various surveys by 2020:

Cloud Type	Year 2011(in US $)	Year 2020(in US $)
Public Cloud	25.5	159.3
Virtual Private Cloud	7.5	66.4
Private Cloud	7.8	15.9
Total	40.8	241.6

The transfer of the research results and the knowledge between cloud and networks and moving the knowledge to external providers may become a striking target to attackers (Tout et al., 2009). These aspects, according to a study conducted by EDUCAUSE based on 372 member institutions (Goldstein, 2009), are considered top barriers. The application of Cloud Computing in Education is going to bring a paradigm shift in teaching learning process in the future.

Considering the mammoth Indian education sector the cloud computing can play a great role. An integrated approach is need of the hour to handle the situation. If the educational data is moved to the cloud, it can be very smoothly accessed by the NKN. The NOFN will be solving the connectivity problem to a great extant. As on date there is no Database of the passed out students of the Universities/Educational Institutions which is a handicap for cross verification/verification of the records in case of malpractices/forgery in India.

India's Telecom Commission proposal to create a US$4.5 billion National Optical Fibre Network (NOFN) has been approved by the Department of Telecom (DoT), announced Shri Kapil Sibal, Minister of Communication and Information Technology. This NOFN will extend the country's existing fibre optic network from the district level to the village level, giving the country of 1.2 billion people services like e-education, e-health, e-banking and also reduce migration of rural population to urban areas, said Sibal[3].

References

1. http://www.mydigitalfc.com/op-ed/cloud-computing-education-112
2. Cloud computing in education, flexibility, and choice for
3. A.Vasan, A. Sivasubramaniam, V. Shimpi, T. Sivabalan, and R. Subbiah, "Worth their Watts?-An Empirical Study of Datacenter Servers," in High Performance Computer Architecture (HPCA),IEEE 16th International Symposium on, pp. 1-10, 2010.
4. http://oprofile.sourceforge.net [Last accessed on 2011 Feb 1].
5. A Cross Section of the Issues and Research Activities Related to Both Information Security and Cloud Computing, Naresh K Sehgal et al, IETE Technical Review pp-279-291,IT A Microsoft U.S. Education white paper, April 2010

6. Rod Fontecilla, "Cloud computing federal government viewpoint," Tech. Rep., Booz Allen Hamilton Inc, 2009.
7. http://www.ugc.ac.in/inside/uni.html
8. "An opportunity for the US government," White Paper, Adobe Systems Incorporated, 2009.
9. http://nkn.in/index.php
10. The Application of Cloud Computing in Education Informatization: Bo Wang et al, 978-1-4244-9763- 8/11/$26.00 ©2011 IEEE pp-2673-2676.
11. Using Cloud Computing in Higher Education: A Strategy to Improve Agility in the Current Financial Crisis, Marinela Mircea et al Academy of Economic Studies, Bucharest, Romania
12. http://yourravi.com/top-10-cloud-computing-service-providing-companies-in-india/
13. http://cloudcomputingtopics.com/2011/08/the-growth-of-cloud-computing-in-india/
14. Reducing Costs Through Better Server Utilization, An Oracle White Paper, April 2010
15. http://www.linkedin.com/news?viewArticle=&articleID=940425128&gid=45151&type=member&item =821966&articleURL=http%3A%2F%2Fwww%2Enetworkworld%2Ecom%2Fnews%2F2011%2F101811-gartner echnology-trends-252100%2Ehtml&urlhash= PYxh&trk= group_most_popularshrttl&goback=%2Egde_45151_ member_82532716